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MEMORANDUM

TO: Wheat Cultivar Release & Recommendation Committee

FROM: Phil Bruckner, Winter wheat breeder

DATE: January 7, 2004

RE: Proposals for HRWW cultivar release and removal of cultivars from recommendation list

The following two motions and supporting documentation are presented for consideration at the 2004 Cultivar Release and Recommendation Meeting in Bozeman:

MTS0031

Motion: That MTS0031 solid-stemmed, hard red winter wheat (HRWW) be approved for release in 2004.

Pedigree: Rampart 's' (MTS92015)//Vanguard/Norstar

Type of release: Public, with PVP, Title 5 option

Potential names: To be named prior to fall, 2004 foundation seed release. Potential names: Genou (Knees), Saber, Brigade, Cavalry, Frontier, Garrison, others?

Selection history: MTS0031 originated from a greenhouse cross made in 1993. The transplanted F₁ population was grown in the field later in 1993. F₂, F₃, F₄, and F₅ bulk populations were grown in Fort Ellis, Bozeman, Dutton, and Bozeman, respectively, from 1994 to 1997. In 1998, 93X321E45 was selected and bulk harvested from a set of 66 F₆ headrows grown in Bozeman. 93X321E45 was subsequently tested in the 1999 Sawfly Observation Nursery grown at Bozeman, Loma, and Molt. In 2000, 93X321E45 was designated MTS0031 and tested in the 2000 Sawfly trial (5 loc). In 2001, MTS0031 was tested in the 2001 Sawfly trial (5 loc) and 2001 Advanced trial (5 loc). In 2002, MTS0031 was tested in the 2002 Intrastate trial (6 loc), 2002 Off-station trial (10 loc), and 2002 Sawfly trial (2 loc). Due to an experimental error (seed source), Rampart was not included as a check entry in any of the 2002 trials. Vanguard was included in the 2002 Intrastate and Off-station trials. In 2003, MTS0031 was tested in the 2003 Intrastate (8 loc), 2003 Off-station (11 loc), and 2003 Sawfly (4 loc) trials. Quality has been evaluated in multi-location Montana trials since 2000. For comparative purposes, MTS0031 is independently contrasted to Rampart (2000, 2001, 2003; 40 LY, tables 1-11), and Vanguard (2002, 2003; 35LY, tables 12-22).

Purification/seed stocks: The increase of MTS0031 was initiated in 2002. A 4-row strip increase approximately 264' long was grown at the Bozeman Post Farm in 2002. Seed for this strip increase was derived from a single F₉ seed increase plot grown at Bozeman in 2001. The 2002 strip increase was rogued carefully to remove any

phenotypic variants. Breeder seed (~1 acre) was grown at the Bozeman Post Farm in 2003 by the MAES Foundation seed program. Twenty-nine acres of MTS0031 was planted at CARC in the fall of 2003 for foundation seed increase.

Description: MTS0031 is a solid-stem HRW wheat line with improved yield potential and cold tolerance relative to Rampart. Stem solidness of MTS0031 is relatively good, although not as good as Rampart. Test weight, maturity, plant height, grain protein, and end-use qualities of MTS0031 are similar to those of Rampart and Vanguard.

Characteristics/comparisons:

Because Rampart was not available as a check in 2002, MTS0031 is independently contrasted to Rampart (2000, 2001, 2003; 40 LY, tables 1-11), and Vanguard (2002, 2003; 35LY, tables 12-22). The primary comparison of interest is the MTS0031 to Rampart comparison as Rampart is the predominant solid-stem winter wheat cultivar in Montana.

Yield. In 40 location-years (LY) of testing in the Montana Winter Wheat Intrastate, Off-station, Advanced, and Sawfly nurseries average yield of MTS0031 (49.3 bu/a) was 8.6% higher than the yield of Rampart (45.4bu/a, Table 1). Yield of MTS0031 was 9.7%, 1.4%, 4.3%, 11.7% and 5.7% greater than Rampart at Bozeman, Havre, Moccasin, Huntley, and Conrad, respectively (Tables 3, 4, 8, 9, 10). Vanguard out yielded Rampart in both the 2003 Intrastate and Off-Station trials. Thus yield superiority of MTS0031 over Vanguard (Tables 12-22) is less than yield superiority of MTS0031 over Rampart (Tables 1-11).

Stem solidness. Stem solidness on the 5 to 25 scale averaged 19.8 for MTS0031, significantly less than stem solidness of Rampart (22.1, Table 1). Intermediate stem solidness scores (14 to 16) were observed for MTS0031 at Bozeman in 2000 and 2003, and also at Havre and Loma in 2003. Intermediate stem solidness scores (17 to 18) for Rampart were observed only at Bozeman in 2000 and 2003. Stem solidness of MTS0031 may be more sensitive to environmental factors than that of Rampart.

Tolerance to sawfly cutting. In six trials where sawfly cutting occurred, MTS0031 showed a tolerant response similar to Rampart and Vanguard (Table 23).

Test weight. Test weight of MTS0031 is equivalent to that of Rampart and Vanguard (Tables 1, 12).

Winter survival. Based on limited data for survival in environments where differential winter survival occurred, MTS0031 exhibits superior survival to Rampart and Vanguard (Tables 1, 12). However, winter survival (and grain yield) of MTS0031 is still less than that of both Neeley and Morgan, at Williston and Sidney (Tables 5, 6, 16, 17).

MTS0031 is of **medium maturity**, heading about the same date as Rampart, and slightly earlier (~1-2 days) than Neeley and Morgan (Tables 1).

Plant height. MTS0031 is similar in height to Neeley, Morgan, Rampart, and Vanguard, averaging 30 inches (Table 1, 40 LY).

Maximum **coleoptile length** of MTS0031 is relatively long (~4.0 inches), similar to Rampart and Vanguard (data not shown).

Grain protein content of MTS0031 is high, but marginally less than that of Rampart and Vanguard (Tables 1, 12).

End-use quality. Based on experimental milling using a Brabender Automat Mill, flour yield of MTS0031 is greater than that of Morgan and Neeley, and similar to that of Rampart and Vanguard (Tables 2, 13). Flour ash content of MTS0031 is relatively low. **Baking qualities** of MTS0031 are within acceptable ranges with relatively high dough strength and absorption, long mixing time, and excellent loaf volume similar to Rampart and Vanguard (Tables 2, 13). MTS0031 has poor potential for Asian noodle products (data not shown).

In summary, MTS0031 is a solid-stem line with improved yield potential and cold tolerance relative to Rampart. Stem solidness of MTS0031 is less than that of Rampart. Test weight, grain protein, maturity, and end-use qualities of MTS0031 are acceptable and similar to Rampart.

MTS0031 Yield, Agronomic and Quality Comparisons, 2000-2003. Comparisons with Rampart as solid stem check

Table 1. All Locations Agronomic Comparisons, 2000-2003.

Variety	Yield bu/a	Test weight lb/bu	Winter survival %	Heading date Julian	Plant height in	Stem solidness (5-25)	Protein %
Loc/years	40	39	2	25	40	16	40
Neeley	52.0**	59.5	59	165.2	29.9	6.4	14.1
MTS0031	49.3	60.1*	51	163.8	30.2	19.8	14.4
Morgan	47.8	59.2	76**	165.7	29.6	6.8	14.1
Rampart	45.4	60.2**	35	163.9	29.3	22.1**	14.7**
LSD (0.05)	2.0	0.4	10.9	0.5	0.6	1.2	0.3
CV %	9.3	1.5	6.2	0.5	4.2	12.3	4.2

** = indicates highest value within a column ns = not significant at $p \leq 0.05$

* = indicates values equal to highest value within a column based on Fisher's protected LSD ($p=0.05$)

Table 2. All Locations Mill & Bake, 2000-2002.

Variety	Flour yield	Ash (Flour)	Mixo. Mixo. time	Mixo. abs.	Baking mix time	Baking abs.	Loaf volume	Crumb grain
Loc/years	12	12	12	12	12	12	12	5
Rampart	66.0*	0.36	4.1	62.0**	7.7	72.6**	1134**	3.2
MTS0031	66.0**	0.36	4.1	61.8*	8.0	71.6*	1116*	3.6
Neeley	64.2	0.37	4.1	60.8	6.1	70.9	1034	3.2
Morgan	64.2	0.37	3.1	59.8	4.3	69.4	1032	3.0
LSD (0.05)	1.1	ns	0.4	1.0	0.9	1.1	36	ns
CV %	2.1	4.5	13.1	1.9	16.9	1.9	4.1	13.5

Table 3. Bozeman, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
Loc/yrs	bu/a	lb/bu	%	Julian	in	(5-25)	%
	5	4		5	5	4	5
Neeley	102.2**	62.5		168.2	35.8	5.7	14.5*
MTS0031	95.3	63.0**		166.3	35.5	16.8	14.3
Morgan	91.1	61.2		168.7	35.4	6.5	14.1
Rampart	86.9	62.3		165.7	34.4	19.8**	15.0**
LSD (0.05)	5.4	0.4		1.2	ns	2.8	0.6
CV %	4.2	0.4		0.5	3.2	14.5	3.0

Table 4. Havre, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
Loc/yrs	bu/a	lb/bu	%	Julian	in	(5-25)	%
	12	12		7	12	7	12
MTS0031	35.8	58.6		164.3	26.5	20.7*	15.6
Neeley	35.5	58.4		165.6	25.7	6.7	15.2
Rampart	35.3	59.3		164.4	25.7	22.7**	15.5
Morgan	33.9	58.6		166.1	25.6	6.7	15.2
LSD (0.05)	ns	ns		1.1	ns	2.1	ns
CV %	9.5	1.5		0.6	4.9	13.2	3.5

Table 5. Sidney, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
Loc/yrs	bu/a	lb/bu	%	Julian	in	(5-25)	%
	1	1	1	1	1		1
Morgan	72.4	62.1	87	163.3	36.2		11.9
Neeley	69.3	63.0	68	162.2	37.2		11.6
MTS0031	61.2	62.5	65	162.0	37.0		12.1
Rampart	50.5	62.2	48	163.4	34.0		15.0
LSD (0.05)	-	-	-	-	-		-
CV %	-	-	-	-	-		-

Table 6. Williston, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	1	1	1	1	1		1
Neeley	69.0	62.4	51	165.3	32.0		13.6
Morgan	67.5	61.5	64	165.7	34.1		13.5
MTS0031	59.1	61.7	37	165.0	33.7		14.8
Rampart	47.4	61.2	23	165.7	31.1		15.4
LSD (0.05)	-	-	-	-	-		-
CV %	-	-	-	-	-		-

Table 7. Kalispell, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	1	1		1	1		1
Neeley	60.9	61.7		156.1	29.1		13.5
MTS0031	57.9	62.8		154.7	28.1		13.0
Morgan	55.8	60.8		156.0	26.5		13.0
Rampart	42.4	61.9		156.2	25.9		14.1
LSD (0.05)	-	-		-	-		-
CV %	-	-		-	-		-

Table 8. Moccasin, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	5	5		2	5		5
Neeley	41.9	56.2		169.5	32.6		15.1
MTS0031	38.8	57.4		167.2	33.4		15.3
Morgan	38.5	56.6		169.8	32.4		14.7
Rampart	37.2	57.8		167.3	33.8		15.0
LSD (0.05)	ns	ns		1.7	ns		ns
CV %	7.4	2.4		0.3	4.3		4.6

Table 9. Huntley, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
Loc/yrs	bu/a	lb/bu	%	Julian	in	(5-25)	%
	9	9		3	9	1	9
Neeley	51.9**	61.0		159.6	29.3	6.9	12.9
MTS0031	48.7*	61.6**		158.6	29.1	21.3	13.0
Morgan	46.4	60.6		160.0	29.3	5.6	13.0
Rampart	43.6	61.4*		158.5	28.1	22.8	13.6
LSD (0.05)	4.8	0.6		ns	ns	-	ns
CV %	10.3	1.1		0.8	4.3	-	4.7

Table 10. Conrad, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
Loc/yrs	bu/a	lb/bu	%	Julian	in	(5-25)	%
	6	6		5	6	4	6
Neeley	44.8	59.2*		165.8	31.0	6.4	13.1
MTS0031	42.5	59.9**		164.2	30.7	21.1	13.8*
Morgan	40.5	58.0		166.4	29.5	7.7	13.8*
Rampart	40.2	59.7*		164.4	30.0	23.3**	14.2**
LSD (0.05)	ns	1.3		1.0	1.1	1.5	0.6
CV %	8.2	1.8		0.4	3.0	6.2	3.3

Table 11. All Locations except Bozeman and Kalispell, 2000-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
Loc/yrs	bu/a	lb/bu	%	Julian	in	(5-25)	%
	34	34	2	19	34	12	34
Neeley	44.4**	59.1	59	164.9	29.1	6.6	14.0
MTS0031	42.3	59.7*	51	163.6	29.5	20.9	14.4*
Morgan	41.2	58.9	76**	165.4	28.8	6.9	14.1
Rampart	39.4	59.9**	35	163.8	28.7	22.9**	14.7**
LSD (0.05)	2.1	0.5	10.9	0.6	ns	1.3	0.3
CV %	10.4	1.6	6.2	0.5	4.4	10.5	4.3

MTS0031 Yield, Agronomic and Quality Comparisons, 2002-2003.
Comparisons with Vanguard as solid stem check

Table 12. All Locations Agronomic Comparisons, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/years	35	35	4	17	35	3	35
Neeley	54.6**	58.3	51	169.0	32.9	5.0	13.9
Morgan	52.6*	58.3	68**	169.8	32.5	5.0	13.7
MTS0031	51.0	58.8*	41	168.0	32.8	18.9*	14.4
Vanguard	49.8	59.1**	27	167.4	33.0	19.7**	14.8**
LSD (0.05)	2.0	0.4	13.2	0.7	ns	3.6	0.3
CV %	8.1	1.5	17.7	0.6	3.8	14.9	4.5

** = indicates highest value within a column

ns = not significant at p<= 0.05

* = indicates values equal to highest value within a column based on Fisher's protected LSD (p=0.05)

Table 13. All Locations Mill & Bake, 2002.

Variety	Flour yield	Ash (Flour)	Mixo. Mixo. time	Mixo. abs.	Baking mix time	Baking abs.	Loaf volume	Crumb grain
Loc/years	4	4	4	4	4	4	4	4
MTS0031	64.2*	0.33	6.6	63.5**	15.2	73.7**	1194**	3.3
Vanguard	65.7**	0.37	5.5	62.4*	10.5	72.7*	1153*	3.3
Morgan	62.4	0.37	4.0	59.6	6.0	69.5	1094	3.5
Neeley	62.7	0.40	5.3	60.3	9.5	70.7	1091	3.0
LSD (0.05)	1.8	ns	1.1	2.3	3.2	2.4	71	ns
CV %	1.8	10.2	13.2	2.4	19.8	2.1	4.0	16.1

Table 14. Bozeman, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/years	2	2		2	2	1	2
Neeley	92.5	58.4		172.5	43.4	5.0	15.4
Morgan	89.4	57.3		172.8	39.9	5.0	14.5
Vanguard	85.7	58.3		170.5	41.6	16.4	15.8
MTS0031	84.8	58.2		171.1	41.6	15.5	15.6
LSD (0.05)	ns	ns		ns	ns	-	ns
CV %	2.1	0.6		0.5	2.7	-	2.3

Table 15. Havre, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	5	5		3	5	1	5
Neeley	40.3	58.1		172.3	27.3	5.0	15.6
Morgan	39.9	58.6		174.1	27.7	5.0	15.5
MTS0031	38.7	58.7		172.0	28.2	21.9	16.2
Vanguard	37.7	59.4		170.8	28.2	21.2	16.0
LSD (0.05)	ns	ns		1.4	ns	-	ns
CV %	8.0	1.5		0.4	5.3	-	3.6

Table 16. Sidney, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	2	2	2	2	2		2
Morgan	60.1**	60.1	86	168.6	34.2		12.8
Neeley	57.2*	60.6	63	167.6	35.6		12.2
MTS0031	46.7	60.4	60	167.0	34.2		12.9
Vanguard	40.5	60.5	36	168.5	33.6		14.8
LSD (0.05)	9.3	ns	ns	ns	ns		ns
CV %	5.7	1.0	18.3	0.4	3.3		6.3

Table 17. Williston, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	2	2	2	2	2		2
Morgan	53.8**	58.0	50**	170.2	31.1		14.3
Neeley	52.5*	58.2	38	170.0	30.6		14.0
MTS0031	40.8	57.8	23	170.2	29.5		15.3
Vanguard	35.3	57.9	17	169.7	28.9		15.2
LSD (0.05)	9.2	ns	7.7	ns	ns		ns
CV %	6.4	0.7	7.5	0.2	6.0		2.8

Table 18. Kalispell, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	2	2		2	2		2
Neeley	91.0	62.3		161.7	34.1		13.0
Morgan	88.7	61.3		161.9	32.5		12.7
MTS0031	84.4	62.9		160.2	32.9		13.2
Vanguard	78.4	62.4		159.2	33.6		13.9
LSD (0.05)	ns	ns		ns	ns		ns
CV %	5.5	0.5		0.7	3.2		4.9

Table 19. Moccasin, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	9	9		3	9		9
Neeley	38.0	56.3		175.1	31.0		14.6
MTS0031	37.1	56.9		173.2	31.7		14.9*
Morgan	36.2	56.6		176.5	31.0		14.3
Vanguard	35.9	56.9		173.3	31.8		15.6**
LSD (0.05)	ns	ns		1.6	ns		0.7
CV %	5.5	1.9		0.4	3.7		4.7

Table 20. Huntley, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
	bu/a	lb/bu	%	Julian	in	(5-25)	%
Loc/ysrs	10	10		2	10		10
Neeley	62.8**	58.9		159.0	34.1		13.3
Vanguard	59.3*	60.0**		156.6	34.3		14.1**
MTS0031	58.4	59.4*		158.5	34.0		13.5
Morgan	57.9	59.0		159.5	34.9		12.7
LSD (0.05)	3.6	0.8		ns	ns		0.6
CV %	6.5	1.4		0.7	3.7		5.1

Table 21. Conrad, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
Loc/yrs	bu/a	lb/bu	%	Julian	in	(5-25)	%
	3	3		1	3	1	3
Vanguard	53.3	60.6		164.0	36.0	21.5	13.1
MTS0031	53.1	59.6		166.0	35.3	19.3	13.3
Morgan	51.6	58.4		169.0	35.0	5.0	12.4
Neeley	51.3	58.4		170.0	35.7	5.0	12.2
LSD (0.05)	ns	ns		-	ns	-	ns
CV %	5.7	1.4		-	3.2	-	3.7

Table 22. All Locations except Bozeman and Kalispell, 2002-2003.

Variety	Yield	Test weight	Winter survival	Heading date	Plant height	Stem solidness	Protein
Loc/yrs	bu/a	lb/bu	%	Julian	in	(5-25)	%
	31	31	4	13	31	2	31
Neeley	49.8**	58.1	51	169.6	32.1	5.0	13.9
Morgan	48.0*	58.2	68**	170.6	32.0	5.0	13.7
MTS0031	46.6	58.6*	41	168.7	32.2	20.6*	14.4
Vanguard	45.7	59.0**	27	168.2	32.4	21.4**	14.9**
LSD (0.05)	2.1	0.4	13.2	0.9	ns	3.1	0.3
CV %	8.9	1.5	17.7	0.6	3.9	7.4	4.7

Table 23. Stem cutting by wheat stem sawfly in six winter wheat trials in north central Montana, 2000-2003.

Year	2000	2001	2002	2002	2003	2003
Trial-loc.	5802	5853	5802	3872	3502	3852
	0-5 scale ¹	0-5 scale ¹	0-9 scale ¹	%	0-5 scale ¹	%
Morgan	3.8	3.0	4.0	6.0	0.7	56.7
Neeley	1.8	2.5	2.5	11.0	1.1	13.3
MTS0031	1.2	1.0	0.5	1.3	0.6	8.3
Vanguard	-	-	-	1.0	0.1	8.3
Rampart	1.5	1.0	1.0	-	0.2	3.3
LSD (0.05)	1.2	1.3	1.1	4.2	0.5	33.5
CV %	30.0	47.4	44.6	41.0	37.5	44.0

¹ Sawfly cutting: 0=none to 5=100% cut.

Motion:

Remove Blizzard, Elkhorn, Erhardt, Judith, Manning, and McGuire from the Montana winter wheat recommended variety list due to: 1) lack of production over the last five years (Montana Agr. Stats), 2) no foundation seed availability, and 3) no seed in the certification program.